

In the claims:

1. (Previously Presented) Computer apparatus configured to discover roles from structure existing amongst users to whom resources have been assigned, the apparatus comprising:

a processor,

an input for receiving a set of nodes of users, and of resources, each user of said set comprising a node with an assignment of resources the sets being partitioned, one part comprising said users and one part comprising said resources, said assignments being incorporated as links between respective users and resources over said partitioning, and

a discovery unit associated with said input and operable via said processor, configured for automatically searching for patterns within said links between said users and said resources,

a grouping unit, associated with said discovery unit, configured to use said discovered patterns to form at least one group from said user nodes or said resource nodes using said automatically discovered patterns, such that users or resources having all of a subset of at least two links to common resources or users are placed into a same group, and

an output unit configured for outputting said group of users or resources as a role.

2. (Previously Presented) The apparatus of claim 1, wherein said relationships are access permissions.

3. (Previously Presented) The apparatus of claim 1, wherein said relationships are usage levels of respective resources by respective users.

4. (Original) The apparatus of claim 2, wherein said relationships further comprise user access permission levels for respective resources.

5. (Original) The apparatus of claim 2, wherein said at least one group is definitive of a user role on said network.

6. (Previously Presented) The apparatus of claim 1, wherein said user nodes comprise entities having attributes, and said relationships represent a respective user possessing a respective attribute.

7. (Original) The apparatus of claim 2, wherein said pattern recognition unit is associated with a search engine operable to use a search tree to begin with a single resource and its associated users, and iteratively to add resources and remove users not having a predefined relationship with said iteratively added resources, to meet a resource number, or a user number constraint.

8. (Original) The apparatus of claim 7, wherein said search engine is operable to use a homogeneity measure to determine whether to consider a candidate grouping in said search.

9. (Original) The apparatus of claim 7, wherein said search engine is operable to use a homogeneity measure to determine in which order to consider a candidate grouping in said search.

10. (Original) The apparatus of claim 7, wherein said search engine is operable within said iterative stages to add further resources common to a current set of users.

11. (Original) The apparatus of claim 10, wherein said search engine is operable to compute a set of all users related to a current set of resources.

12. (Original) The apparatus of claim 11, wherein said search engine is operable to consider for expansion all resources outside said current set of resources that have at least one relationship connection with a current set of users.

13. (Original) The apparatus of claim 8, wherein the set of users associated with each of said nodes is associated with attributes, and wherein said homogeneity

measure is the percentage of occurrence of a given attribute, multiplied by the log value thereof, summed over all such users in said result.

14. (Original) The apparatus of claim 8, wherein the set of resources associated with each of said nodes is associated with attributes, and wherein said homogeneity measure is the percentage of occurrence of a given attribute, multiplied by the log value thereof, summed over all such resources in said result.

15. (Original) The apparatus of claim 8, wherein said homogeneity measure is the percentage of occurrence of a given resource relationship for any of the users associated with at least one of the resources of said node, multiplied by the log value thereof, summed over all users of said node in said result.

16. (Original) The apparatus of claim 8, wherein said homogeneity measure is the percentage of occurrence of a given user relationship for any of the resources associated with at least one of the users of said node, multiplied by the log value thereof, summed over all resources of said node in said result.

17. (Original) The apparatus of claim 1, wherein said pattern recognition unit is operable to use said pattern recognition within an iterative tree searching process.

18. (Previously Presented) The apparatus of claim 1, wherein said pattern recognition unit is operable to insert said groupings as an intermediate set amongst said nodes.

19. (Previously Presented) The apparatus of claim 1, wherein said users and said resources are arranged into three sets, an intermediate one of said sets comprising predetermined relationship dependent groupings of at least some of the users in a first of said sets, said pattern recognition unit being operable to use said pattern recognition to add new groups to said intermediate set.

20. (Previously Presented) The apparatus of claim 1, wherein said input is associated with a graphical expositor, configured to present said input in a graph, said graphical expositor being operable to graphically represent said user nodes and said resource nodes within said sets.

21. (Original) The apparatus of claim 20, wherein the graphical expositor is user interactive to manually modify the groupings discovered by the pattern recognition engine.

22. (Previously Presented) The apparatus of claim 20, wherein said graphical expositor is further operable to partition the graph into sub-graphs, each of the sub-graphs itself being a partitioned graph having at least two sets, the sub-graphs being limited to a subset of the users in one of the sets, and further comprising all the resources in the other set that are linked to users of said subset, and wherein said pattern recognition unit is further operable to perform groupings on each of the subgraphs, and then to merge the results into a full graph.

23. (Previously Presented) The apparatus of claim 20, wherein said graphical expositor is further operable to partition the graph into sub-graphs, each of the sub-graphs itself being a bi-partite graph limited to a subset of the resources in the second set, and further comprising all the users in the first set that are linked thereto, and wherein said pattern recognition unit is further operable to perform groupings on each of the subgraphs, and then to merge the results into a full graph.

24. (Original) The apparatus of claim 20, wherein said graphical expositor, is user interactive to allow an operator to review user group associations and user resource relations, and to allow said operator to manipulate user access rights.

25. (Previously Presented) Role discovery method for electronically grouping nodes according to existing relationships with resources, the method comprising:

receiving an arrangement of nodes and resources, said resources being partitioned from said nodes and with predetermined relationships between ones of said resources and corresponding nodes, and

automatically discovering existing relationship patterns between said arrangement of nodes and resources across said partitioning,

using said discovered patterns, grouping said arrangement of nodes, wherein said grouped nodes share relationships with at least two common resources, and

outputting said grouping of nodes having common patterns of at least two existing relationships as a role.

26. (Previously Presented) A reverse engineering device for discovering existing structure in a partitioned arrangement of nodes and resources wherein nodes have relationships with various of said resources, the device comprising:

a processor,

an input configured for receiving said partitioned arrangement of nodes and resources, said arrangement comprising at least two sets, said partitions being of said nodes and said resources respectively, and with predetermined relationships defined between said nodes and said resources across said sets, and

a discovery unit configured to work with said processor, for automatically discovering relationship patterns within said existing relationships using pattern recognition on said nodes, said resources and said predetermined relationships,

a node-grouping unit associated with said pattern recognition unit and configured to operate with said processor to use said relationship patterns to form groups from said nodes, such that those nodes that share similar subsets of at least two relationships with said resources are placed in a group together, and

an output configured to output respective groups of nodes having said similar subsets of at least two relationships as roles.

27. (Currently Amended) Computer device comprising:

a processor

a first series of user definitions, each user in said definitions defined as a user node;

a second series of resource definitions, each resource in said definitions defined as a resource node;

access data indicating access of users to respective resources; and

a pattern recognition unit operable with said processor for automatically recognizing pre-existing patterns in said access data, said patterns indicative of a way of grouping said user nodes of said each user so as to discover groups of nodes having common subsets of at least two resources, and

a group definition unit operable with said processor and said pattern recognition unit configured to output groups so discovered as roles.

28. (Previously Presented) The apparatus of claim 1, wherein said role comprises said users or said resources sharing only said subset.

29. (Previously Presented) Pattern recognition apparatus for grouping nodes according to relationships with other nodes, the apparatus comprising:

an input for receiving nodes partitioned into a first set and a second set, and with relationships between nodes in respective first and second sets defined by links across said partition, and

a pattern recognition processor associated with said input, for using pattern recognition on said links to find relationship patterns within said links, and from said patterns to form at least one group from nodes of said first set, wherein said nodes being formed into said group share relationships with at least two nodes in said second set.

30. (Previously Presented) Group discovery method for automatically discovering groups according to an initially unknown structure in existing electronically held data, said electronically held data comprising nodes partitioned into first and second data sets, wherein links exist within said data between nodes in said first data set and nodes in said

second data set, the initially unknown structure being within said links, the method comprising:

electronically searching said data, and

grouping nodes in said first set according to respective links such that all nodes in said first set having links to at least two commonly held nodes in said second set are assigned to a same group, thereby discovering groups in said data according to said initially unknown structure.

31. (Previously Presented) A method of automatically grouping users having links or attributes into one or more groups based on said links or attributes, the method comprising:

providing a group for users sharing all of a subset of at least two of said links or attributes, and

outputting said provided groups.

32. (Previously Presented) The apparatus of claim 1, wherein said discovery unit is configured to carry out said searching by one member of the group consisting of a clustering algorithm, an incremental search and a search tree.

33. (Previously Presented) The apparatus of claim 1, wherein said outputting said group comprises outputting a characteristic of said group.

34. (Previously Presented) A search method for automatically searching initially unknown structures in existing electronically held data, said electronically held data comprising nodes partitioned into first and second data sets, wherein links exist within said data between nodes in said first data set and nodes in said second data set, the initially unknown structure being within said links, the method comprising:

electronically searching said data according to said links, and

grouping nodes in said first set according to respective links such that all nodes in said first set having links to at least two commonly held nodes in said second set are

assigned to a same group, thereby discovering groups in said data according to said initially unknown structure.

35. (Previously Presented) Search apparatus for automatically searching initially unknown structures in existing electronically held data, said electronically held data comprising nodes partitioned into first and second data sets, wherein links exist within said data between nodes in said first data set and nodes in said second data set, the initially unknown structure being within said links, the apparatus comprising:

a search unit, configured for electronically searching said data according to said links, and

a structuring unit, associated with said search unit, configured for grouping nodes in said first set according to respective links such that all nodes in said first set having links to at least two commonly held nodes in said second set are assigned to a same group, thereby discovering groups in said data according to said initially unknown structure.